

Ollscoil na hÉireann, Gaillimh

National University of Ireland, Galway

SEMESTER II EXAMINATIONS, 2002/2003

B.E. DEGREE (ELECTRONIC)

POWER ELECTRONICS

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Duration of examination: Two Hours

Instructions: Answer *three* questions.
All questions carry equal marks

- 1 Figure 1 shows the circuit diagram of a current fed bridge inverter with the load voltage and current waveforms. Label the operation of the switches to give the correct output current waveform.
- What value of δ would eliminate the third harmonic completely.
 - Describe a method whereby the fifth harmonic could be eliminated.
 - For $I_{dc}=100$ A, $V_{ac}=100$ V, $\theta=10^\circ$, $\delta=30^\circ$, calculate the average power delivered to the load.

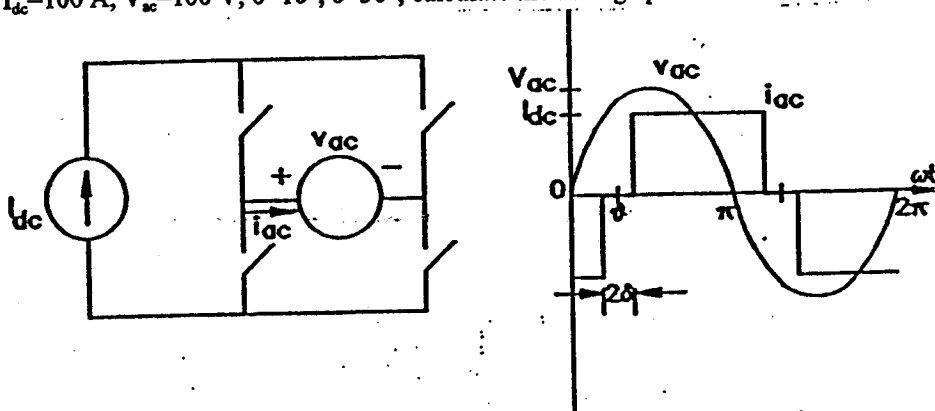


Figure 1

- 2 Figure 2 shows a light dimmer circuit with phase controlled rectification.

- Explain in detail the operation of the unijunction transistor in this circuit.
- Calculate the minimum and maximum values of the resistor R_f .
Assume the following parameters for the unijunction transistor: intrinsic stand-off ratio 0.69, valley point current = 5 mA, valley point voltage = 2 V, peak point current = 1 μ A and the forward voltage drop = 0.5 V.

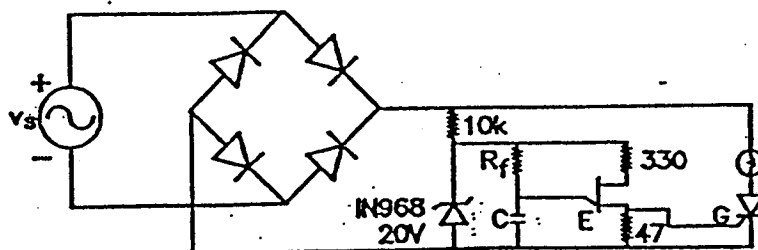


Figure 2

3 A 2-hp, 375 V, 1750 RPM shunt motor has an armature resistance $R_a = 1 \Omega$, armature inductance $L_a = 100 \text{ mH}$ and a voltage constant $K_m = 1.3 \text{ V-s/r}$. The motor is operated from a 50 Hz three-phase line, rated at 240 V line to line, through a full wave phase controlled rectifier at rated armature current.

- (a) Find the delay angle of the armature converter α for rated speed. Assume each SCR has a forward voltage drop of 1 V and that conduction is continuous.
- (b) Determine the ripple amplitude of the armature current at $\alpha = 90^\circ$. The motor is carrying rated armature current and is stalled. Assume R_a is negligible for this calculation.
1 hp = 746 W

4 Write a short note on two of the following power semiconductor devices under the following headings

- Circuit symbol
- Device physics
- Device characteristics
- Device applications

- (a) Silicon Controlled Rectifier (SCR)
- (b) Schottky diode
- (c) Power MOSFET